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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

John Dash and Patrick S. Keefe

Art Unit 2204

Serial No. 07/996,967

Filed: December 23, 1992

For: LOW TEMPERATURE NUCLEAR FUSION

Examiner: H. Behrend

FIRST DECLARATION PURSUANT TO 37 C.F.R. § 1.132

TO THE COMMISSIONER
OF PATENTS AND TRADEMARKS:

Sir:

1. I, John Dash, am a co-inventor on the application referenced above, which is a continuation application of U.S. patent application Serial No. 07/509,585, filed on April 16, 1990, entitled "Low Temperature Nuclear Fusion." I have read and understood the specification and claims of both of these applications.

2. I received a Bachelor of Science in Metallurgy from Pennsylvania State University in 1955. I then received a Masters degree in Metallurgy from Northwestern University in 1960. Finally, I received a Doctorate in Metallurgy from Pennsylvania State University in 1966.

3. I have had extensive training and experience in scientific research activities, including the physical and

chemical aspects of electrochemistry, since at least as early as 1955. I have been a professor at Portland State University since 1966. I currently am employed as a full professor of physics at Portland State University. A copy of my resume is attached to this Declaration as Exhibit 1.

4. Under my guidance, several recent experiments were performed using Platinum anodes and Palladium cathodes. Two identical cells were used. The first cell contained an electrolyte of primarily H_2O , which contains a small amount of primarily D_2O , and H_2SO_4 (H-cell) and the second cell contained D_2O and H_2SO_4 (D-cell). The cells were electrically connected in series. In summary, thermal output, localized melting of the cathode, and localized concentrations of Au or Ag on the cathode were observed in both cells. However, the D-cell which contained more D_2O than the H-cell experienced greater thermal output, localized melting, and localized concentrations of unexpected elements, which are consistent with the postulate that nuclear fusion has occurred.

5. The following methods were used in performing the experiments:

(a) Both the H-cell and the D-cell contained cold-rolled, 0.35 mm thick polycrystalline Pd cathodes and 0.03 mm

thick Pt anodes. Both cells also contained a recombination catalyst.

(b) In one experiment, a voltage of about 3.5 volts was applied to the electrodes for about twelve minutes. Rimmed craters were observed on the surface of the cathode in the D-cell, suggesting that localized melting had occurred. No similar results were observed on the surface of the cathode in the H-cell. In a different, but similar experiment in which the cells were electrolyzed for 400 hours, greater thermal output was observed from the D-cell than from the H-cell for the first 300 hours of operation.

(c) Following electrolysis, the electrodes were sonically cleaned in ionized water. I then examined the surface topography and composition of the Pd cathodes from both cells. A scanning electron microscope (SEM) was used to photograph these electrodes. Those portions of the cathodes which were not submerged in the electrolyte were left unchanged, having a smooth, shiny surface. However, those portions of the cathode which were immersed in the electrolyte experienced significant surface changes.

(d) Exhibit 2 attached to this declaration shows a photograph of a small portion of the bottom of the H-cell Pd cathode on a concave side. The original smooth, shiny surfaces

changed to dull, corrugated topography. Dark spots were present on the lower ends of both cathodes, where the shape changes were greatest. The dark spots were most probably caused by localized differences in the topography.

(e) Localized differences in chemical composition of the cathode were observed by using an energy dispersive spectrometer (EDS), which was attached to the SEM. EDS gives surface analysis to a depth of about one μm . The composition of area A in Exhibit 1 is shown in the spectrum in Exhibit 3. This relatively smooth, flat area with little contrast appears to have no heavy elements other than Pd. The spectrum of Region B, which appears darker and rougher with more contrast, is shown in Exhibit 4. This spectrum shows that region B of the cathode included an appreciable amount of Pt and Au in addition to Pd. Similar spectra were obtained from regions C and D shown in Exhibit 2. The Pt likely is plated from the electrolyte, which contains Pt due to slow dissolution of the Pt anode. Au, however, is not expected to arise from a pure Pt anode. Nor is it expected to occur inhomogeneously as an impurity in Pd because Au and Pd are completely miscible in the solid state. Therefore, it is difficult to explain how a greater concentration of Au could be deposited on the Pd cathode either by plating from the electrolyte or by diffusion from within the cathode.

(f) Similar analysis of the bottom of the D-cell Pd cathode on the concave side also revealed Au in localized regions. The concentration of Au on the D-cell Pd cathode is greater than that on the H-cell cathode. For example, analysis of an active area of 10^{-3} mm² on the D-cell cathode gave 6% Au compared with 3% Au for an active area of the same size on the H-cell cathode.

(g) Therefore, because the concentration of Au produced increased as the D₂O concentration increased, the production of Au in the cells is consistent with the postulate that nuclear fusion occurs in the presence of D₂O and H₂SO₄. Both cells used the same materials, except that the D-cell contained D₂O (Baker analyzed G210-05) and the H-cell used deionized H₂O. Water naturally contains a small amount of D₂O, which may explain the production of gold on the H-cell cathode. Both cells were electrolyzed for exactly the same time with exactly the same current. The only difference was that the D-cell contained more D₂O than the H-cell.

6. I believe that the production of Au can be explained by transmutation caused by neutrons. The D-cell produced more excess heat than the H-cell, and the concentration of Au on the D-cell Pd is greater than that on the H-cell Pd cathode. If the excess heat was caused by nuclear fusion, then neutrons may have

been released. In the presence of hydrogen, transmutation may be greatly enhanced. If a neutron is captured by Pt^{196} , an abundant isotope, it becomes Pt^{197} , which quickly decays to Au^{197} , a stable isotope.

7. In addition to yielding localized concentrations of Au, the experiments also produced a thermal output. The following experimental methods were used to measure this thermal output:

(a) Two open electrolytic cells were electrically connected in series, using 0.03 mm Pt anodes and 0.055 mm Pd cathodes. The electrodes were made from the same sheets used for the electrodes in the experiment described above. The water jacket of the D-cell contained 8 g more water than that of the H-cell. Thus, the mass of the D-cell exceeded the mass of the H-cell by about 8 g. The current density was about 0.7 A/cm^2 . The voltage drops across the cells were controlled by adjusting the proximity of the electrodes and the immersed surface area of the anode. A PC-based data acquisition system manufactured by Kiethly-Metrabyte recorded thermocouple voltages at four positions in the water jackets around the circumference of each cell. The thermocouples (copper-constantan with electronic icepoints) were accurate to $\pm 0.5^\circ\text{C}$.

(b) Electrolysis was performed for five hours, then discontinued. The Pd cathodes were washed with deionized water,

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then sonically cleaned in acetone prior to being examined and photographed with a light microscope, and with a scanning electron microscope.

(c) A computer program averaged the four water-jacket temperatures in each cell. The average in the H-cell was then subtracted from the average in the D-cell for every data point. The average, maximum, and minimum of this difference were recorded for every ten minutes of data. The power input to each cell was also averaged and the minimum and maximum recorded over the ten minute periods.—As shown in Exhibit 5, the power input to the D-cell was maintained at least 0.1 watt less than the power input to the H-cell. Nevertheless, and even though the mass of the D-cell exceeded that of the H-cell, the temperature of the D-cell was the same or higher than that of the H-cell throughout the experiment, as shown by the graphs in Exhibit 6. Exhibit 6 shows the difference in power input and the difference in temperature between the H-cell and D-cell during the experiment. The positive value for the average D-H temperature, and a negative value for the difference (D-H) in power input, indicate that the D-cell was producing more heat per unit power input than the H-cell.

8. The production of heat could be caused by energy released during the production of Ag. Exhibit 7 shows a portion

of the Pd cathode near the edge where melting occurred. The particle indicated by point 4 on Exhibit 7 contains about 50% Ag. Assuming that this concentration occurs in the volume $25 \times 10^{-9} \text{ mm}^3$, this particle contains about 2.14×10^{12} atoms, half of which are Ag. Assuming that 2.5 MeV is released along with each neutron from a fusion reaction, then about 0.4 J would have been produced along with the Ag in the particle at point 4. Assuming an average specific heat of $0.26 \text{ J/g}^\circ\text{C}$ and a mass of $3 \times 10^{-10} \text{ g}$ for the particle, the temperature of the particle would have increased to the melting point by absorption of about 10^{-6} J . Assuming a thermal output of the D-cell greater than the thermal output of the H-cell of 0.1 watt, the additional heat produced by the D-cell was 1800 J. The 1800 J of excess heat could have been produced by about 0.4% of the volume of the electrode.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may

jeopardize the validity of the application or patent issued thereon.

7-22-94

Date

John Dash
John Dash

CURRICULUM VITA

John Dash

EDUCATION

B.S. Pennsylvania State University, 1955
M.S. Northwestern University, 1960
Ph.D. Pennsylvania State University, 1966

PROFESSIONAL EXPERIENCE

1955-1958	Research Metallurgist, Crucible Steel Company, Midland, PA
1960-1963	Research Associate, Res. Inst. for Advanced Study, Baltimore, MD
1963-1965	Teaching Assistant, Pennsylvania State University
1966-1971	Assistant Professor, Portland State University
1971-present	Professor, Portland State University
1985-present	President, Electrochemical Innovations, Inc.

RESEARCH AND TEACHING FIELDS

Research Fields:

Electrolytic Reaction, Phase Transformations, Electron Microscopy

Teaching:

Electron Microscopy, Physical Metallurgy, Thermodynamics, Environmental Sciences and Resources

PUBLICATIONS RELATED TO ELECTROLYTIC REACTIONS

1. "Magnetic stirring during electrolytic thinning," Proceedings of the Electron Microscopy Society of America, St. Paul, 1969 (Baton Rouge, Claiborne's Book Store, 1969), p. 144.
2. "Electrodeposition of metals in magnetic fields," Proceeding of the Electron Microscopy Society of America (Baton Rouge, Claiborne's Book Store, 1971), with W.W. King.

3. "Electrothinning and electrodeposition of metals in magnetic fields," J. Electrochem. Soc. 119, 51 (1972), with W.W. King.
4. "Influences of magnetic fields on the energy output of Leclanche cells," Extended Abstracts of the Electrochemical Society 71-2, p. 45, Dallas, TX, October 1975, with W. Socha.
5. "Effects of magnetic fields on the structure of electrodeposited copper," Proc. 38th Annual Meeting of EMSA, San Francisco, 1980 (Baton Rouge, Claitor's Publishing Div.) p. 144, with K. Housen.
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7. "Improving efficiency of Cr plating with higher sulfate and Cr (III)," AES 69th Annual Technical Conference Proceedings, Vol. 2, Paper U4, San Francisco, June 1982, with A. Kasaaian.
8. "Use of alcohol for increasing the current efficiency of chromium plating," U.S. Patent No. 4,447,299 with A. Kasaaian. Application also filed for Canadian patent.
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10. "Effect of magnetic fields on the morphology of electrodeposited copper," Proc. 41st Annual Meeting of EMSA, Phoenix, 1983 (San Francisco Press), with H. Takeo and S. Ma.
11. "Effect of magnetic fields and flow applied to single electrodes on electrolytic cell potentials," J. Appl. Phys. 55, 2604 (1984), with M. Takeo.
12. "The effect of magnetic fields applied during aqueous electrolysis on circulation and on electrode processes," J. Appl. Phys. 55, 2060 (1984), with C. Cousins and C. Gorg.
13. "Magnetic effects on electroplating of copper," Proc. AES 11th Plating in the Electronics Industry Symposium, Orlando, Feb. 1984, with H. Takeo and C. Tam.

14. "High efficiency chromium and chromium-iron plating," AES 71st Annual Technical Conf. Proc., NY, July 1984, with A. Kasaaian.
15. "SEM and EDS study of magnetic effects on electroplating of Cr-Fe alloys," Proc. 42nd Annual Meeting of Electron Microscopy Society of America, (San Francisco Press, 1984) p. 502 with C. Cousins.
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18. "Chromium-iron alloy plating using hexavalent and trivalent chromium ion solutions," U.S. Patent 4,615,773, with A. Kasaaian.
19. "Effect of methanol and formic acid on chromium plating," Plating and Surface Finishing 71, No. 11, 66 (Nov. 1984), with A. Kasaaian.
20. "Effects of chromium electroplating solution composition on properties of the deposits," AES 72nd Annual Technical Conference Proceedings, paper P4, Detroit, July 1985, with A. Kasaaian and W.F. Lanford.
21. "Electrolytic codeposition of alumina with copper in a magnetic field," Extended Abstracts, Electrochemical So., Las Vegas, Oct. 1985, with J. Anderton, B. Litzenberger and A. Trzynka.
22. "Codeposition of metals and nonmetallic particles," U.S. Patent, May 1987.
23. "Chromium plating from a solution containing Cr (VI), Cr (III), and Iron," Proc. Int. Chromium Colloquium, San Diego, CA, Feb. 1987, with A. Kasaaian and M. Hotchkiss.

PROFESSIONAL SOCIETIES

American Society for Metals - member since 1955; Chairman, Penn State Chapter, 1965-66; Chairman, Oregon Chapter, 1977-78.

American Electroplaters' Society - member since 1980; Chairman, Education Committee 1983-86.

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Sigma Xi - member since 1965.

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American Electroplaters' Society Silver Medal Award for outstanding paper published in Plating and Surface Finishing during 1984, with A. Kasanian.

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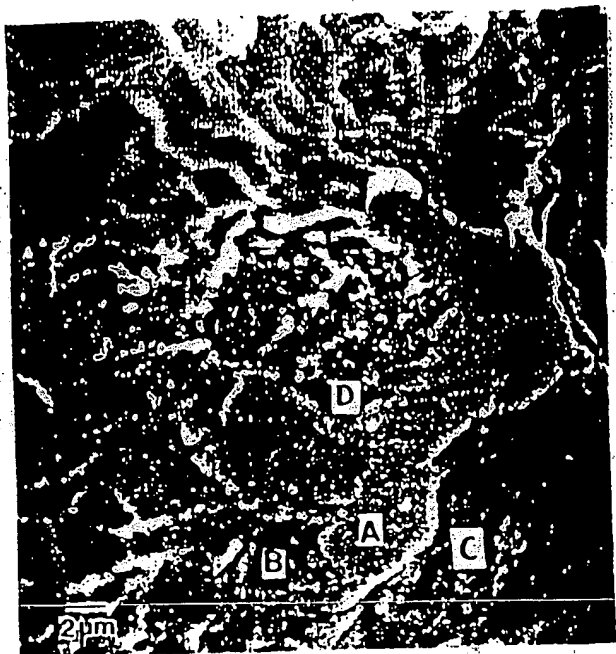


EXHIBIT 2

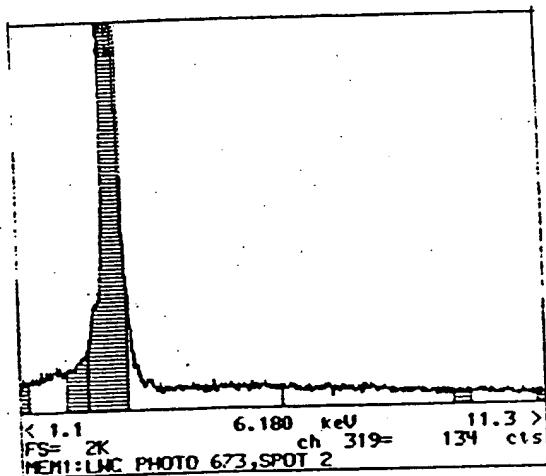


EXHIBIT 3

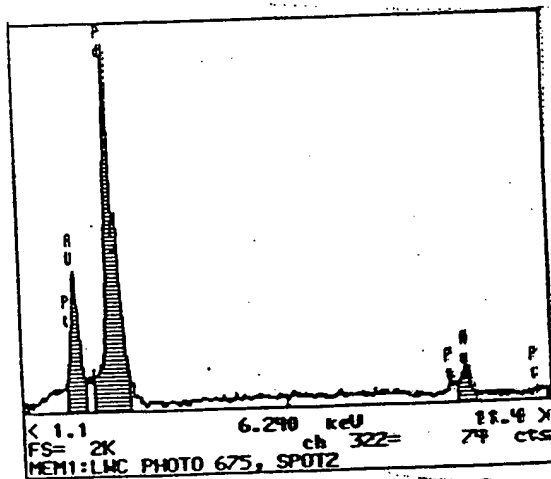


EXHIBIT 4

Difference in Power Input vs. Time (D cell less H cell) 6/30/93

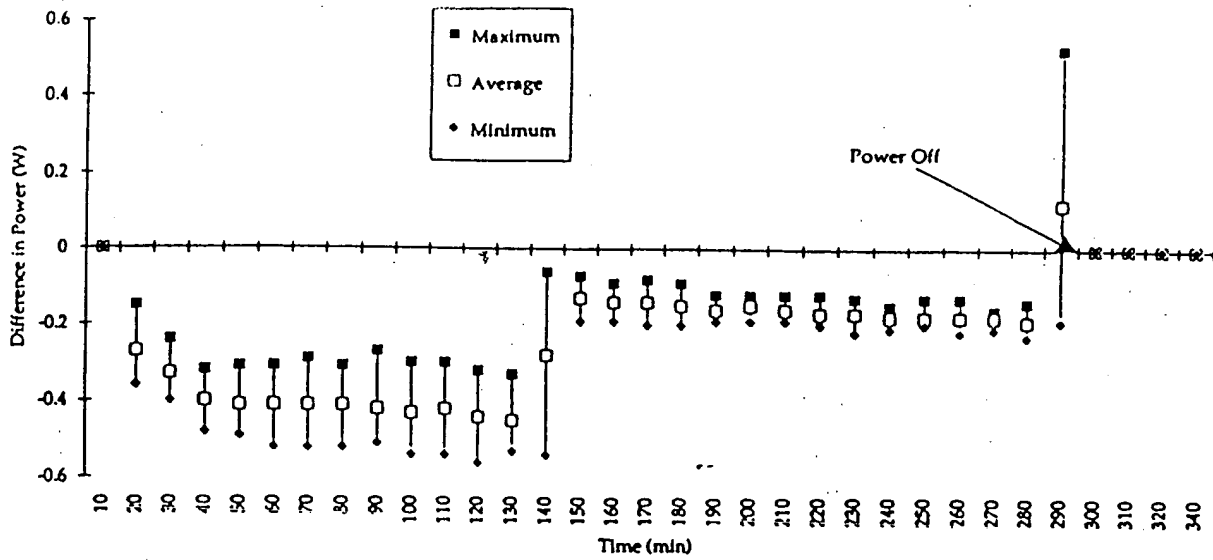


EXHIBIT 5

Difference in Water Jacket Temperature vs. Time (D cell less H cell) 6/30/93

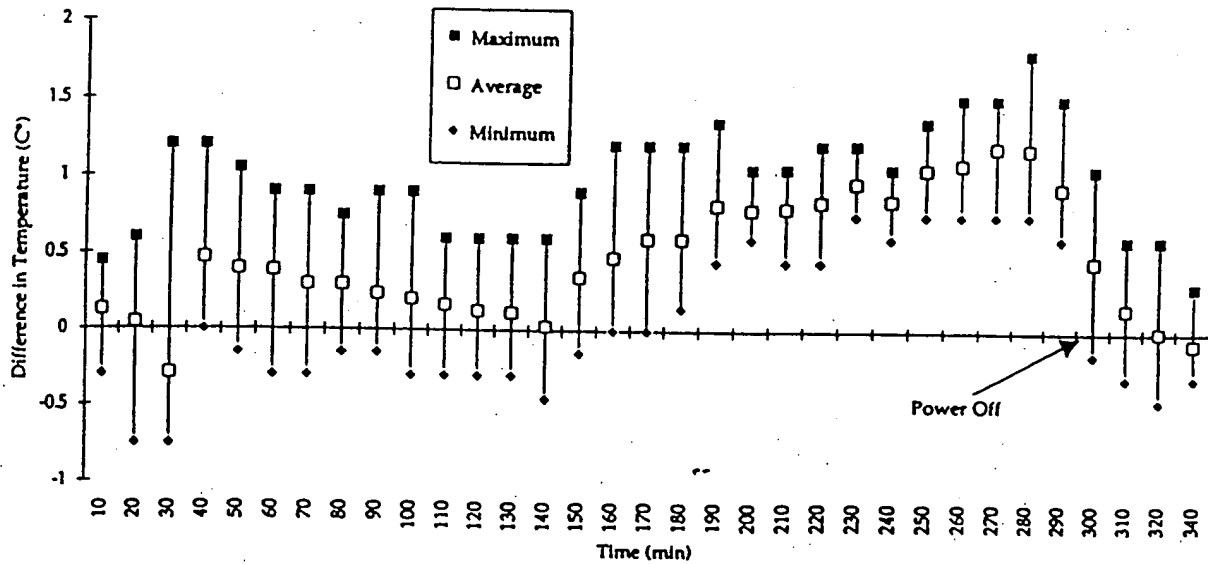
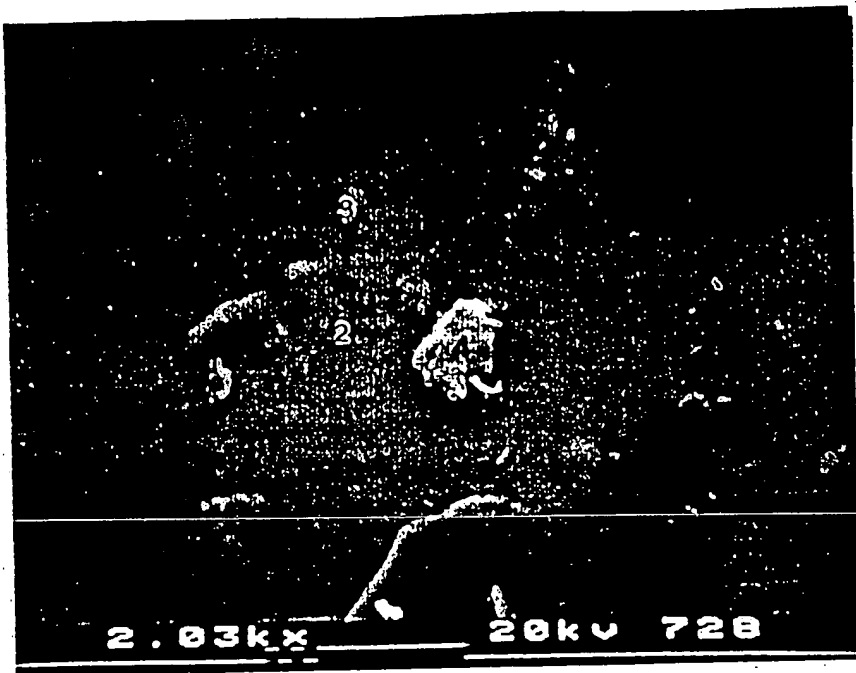


EXHIBIT 6



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SECOND DECLARATION PURSUANT TO 37 C.F.R. § 1.132

TO THE COMMISSIONER
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Sir:

1. I, John Dash, am a co-inventor on the application referenced above, which is a continuation application of U.S. patent application Serial No. 07/509,585, filed on April 16, 1990, entitled "Low Temperature Nuclear Fusion." I have read and understood the specification and claims of both of these applications.

2. I received a Bachelor of Science in Metallurgy from Pennsylvania State University in 1955. I then received a Masters degree in Metallurgy from Northwestern University in 1960. Finally, I received a Doctorate in Metallurgy from Pennsylvania State University in 1966.

3. I have had extensive training and experience in scientific research activities, including the physical and

chemical aspects of electrochemistry, since at least as early as 1955. I have been a professor at Portland State University since 1966. I currently am employed as a full professor of physics at Portland State University. A copy of my resume is attached to this Declaration as Exhibit 1.

4. Under my guidance, several experiments were performed during the summer of 1994. The experiments involved cells constructed using platinum anodes. A first cell contained an electrolyte of D_2O and H_2SO_4 (C-cell) and a Pt cathode. The second cell contained D_2O and H_2SO_4 (D-cell) and a Pd cathode. The cells were connected in series. In summary, I observed thermal output which is consistent with the postulate that nuclear fusion has occurred.

5. The experiment was conducted as follows:

(a) Two containers inert to a mixture of H_2SO_4 and D_2O were used. Within the container for the C-cell was provided an anode of platinum and a cathode of cold-rolled Pt. The D-cell anode was also Pt, but the D-cell cathode was cold-rolled Pd. D_2O and H_2SO_4 were placed in both cells.

(b) The anode of the D-cell was connected to the cathode of the C-cell, the anode of the C-cell was connected to the positive terminal of a power source, and the negative terminal of the power source was connected with the cathode of

the D-cell. Current flow through and voltage across the above connections were measured by an ammeter and voltmeter, respectively. Thermocouples were used to measure the temperature of the electrolyte in each of the cells.

(c) A voltage was applied across the cells for several hours.

(d) At the end of the experiment, the energy produced by the D-cell was greater than the energy produced by the C-cell. This heat energy was calculated knowing the specific heat of the electrolytes and components in the two cells, the loss of energy to the environment through heat transfer, the time of the electrolysis, and the temperatures of the cells.

6. The results from these experiments are summarized on graphs attached to this Declaration as Exhibits 2-7. Three different experiments were run as described below.

a) The first experiment was conducted on June 27, 1994, as shown by Exhibit 2. The power input to the C-cell as shown by Exhibit 2 started at about 3.4 watts, decreased over the first 20 minutes to about 2.8 watts, and remained at that power input for the duration of the experiment. The power input to the D-cell started at about 3.1 watts, and except for one measurement, decreased to 2.6 watts, where it remained for the

duration of the experiment. Therefore, the power input to the D-cell was, at all times, less than the power input to the C-cell.

The corresponding temperatures of the cells are shown in Exhibit 3. Although both cells started at about 24° C, after about 20 minutes, the temperature of the electrolyte in the D-cell was between about 5° and 10° C warmer than the C-cell, despite having a lower power input.

b) The second experiment was conducted on June 28, 1994, as shown by Exhibit 4. The initial power input to the C-cell was about 4.5 watts, and decreased to about 3.8 watts after 20 minutes. The power input thereafter remained between 3.8 watts and about 4 watts. The power input to the D-cell started at about 4.2 watts, decreased to about 3.5 watts at 20 minutes, and thereafter remained between about 3.5 and 3.7 watts. At all times, the power input to the C-cell was greater than the power input to the D-cell.

The corresponding temperatures of the cells are shown in the graph attached hereto as Exhibit 5. Both cells started at about 25° C. After about 20 minutes, the temperature of the D-cell was between 5° and 10° C warmer than the temperature of the C-cell. This temperature differential was maintained for the duration of the experiment. Therefore, although at all times the power input to the C-cell was greater than the power input to the D-cell, the

temperature of the D-cell was greater than the temperature of the C-cell.

c) The third experiment was conducted on June 29, 1994. As shown in Exhibit 6, the power input to both cells started at about 6 watts and decreased to about 5 watts after 20 minutes. Thereafter, the power input to the C-cell increased over the duration of the experiment to about 7.5 watts. The power input to the D-cell increased to about 5.8 watts. At all times after about 10 minutes, the power input to the C-cell was greater than the power input to the D-cell.

The corresponding temperatures of the cells are shown in the graph attached hereto as Exhibit 7. Both cells started at about 35° C and increased to about 74° C over the duration of the experiment. Throughout most of the experiment and after about 10 minutes, the temperature of the D-cell was from about 5° to about 10° C greater than the C-cell. Between 100 minutes and 160 minutes, as the difference between the power input to the C-cell and the power input to the D-cell became larger, the temperature of the C-cell became closer to the temperature of the D-cell. At all times, however, the temperature of the D-cell was greater than the temperature of the C-cell, despite a much lower power input. The experiment ended when the Pd cathode in the D-cell

suddenly melted. The molten Pd reacted with the electrolyte and converted it to a solid Pd-S compound.

7. These experiments demonstrate that the increased thermal output of a D-cell versus an C-cell is reproducible. I previously have submitted evidence concerning seven previous experiments that also resulted in a higher temperature in a D-cell for the same or lower power input to the D-cell. These three additional experiments make a total of 10 experiments which all verify that a D-cell produces a higher thermal output than the control cell.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or patent issued thereon.

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1971-present Professor, Portland State University
1985-present President, Electrochemical Innovations, Inc.

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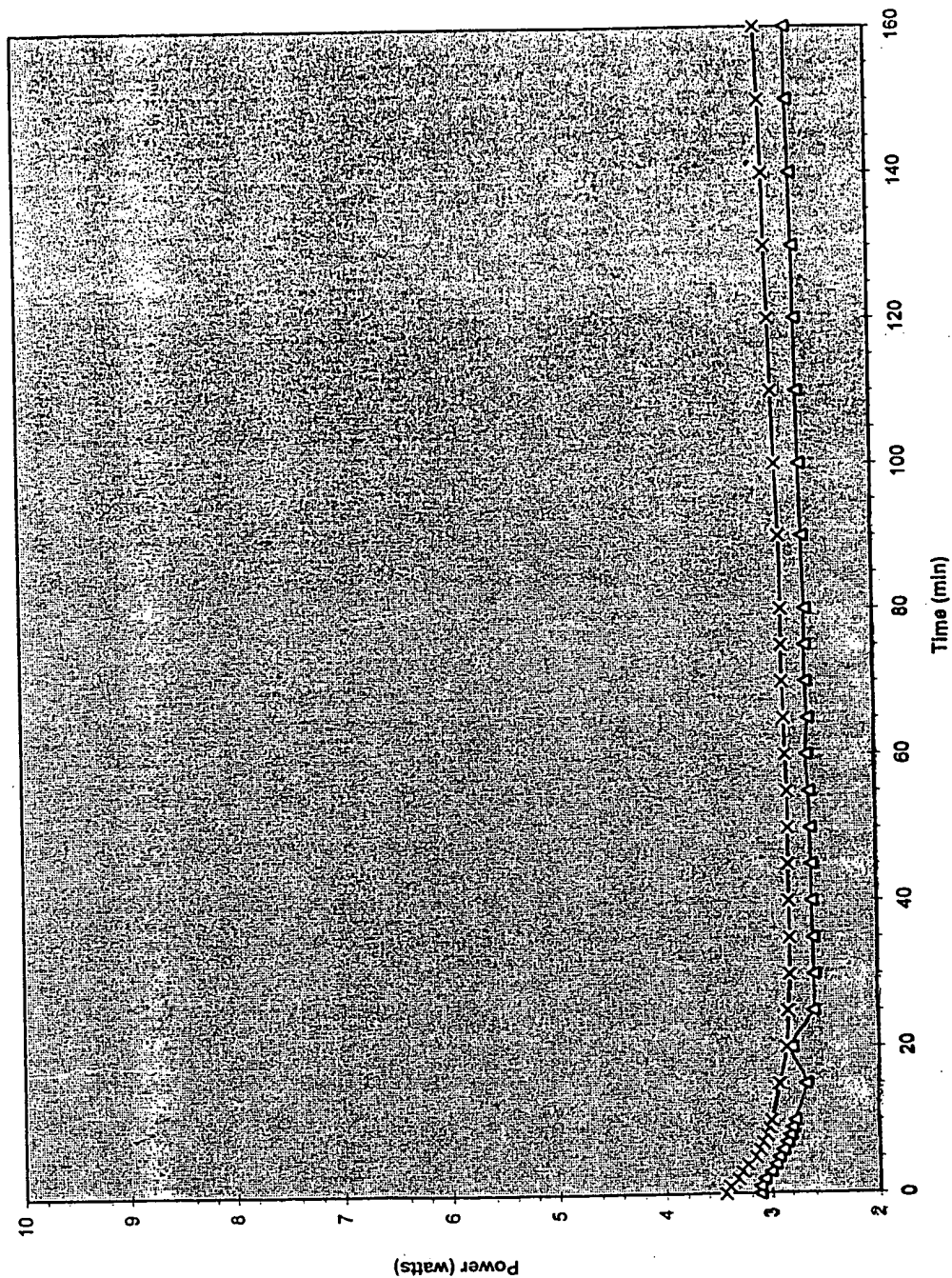
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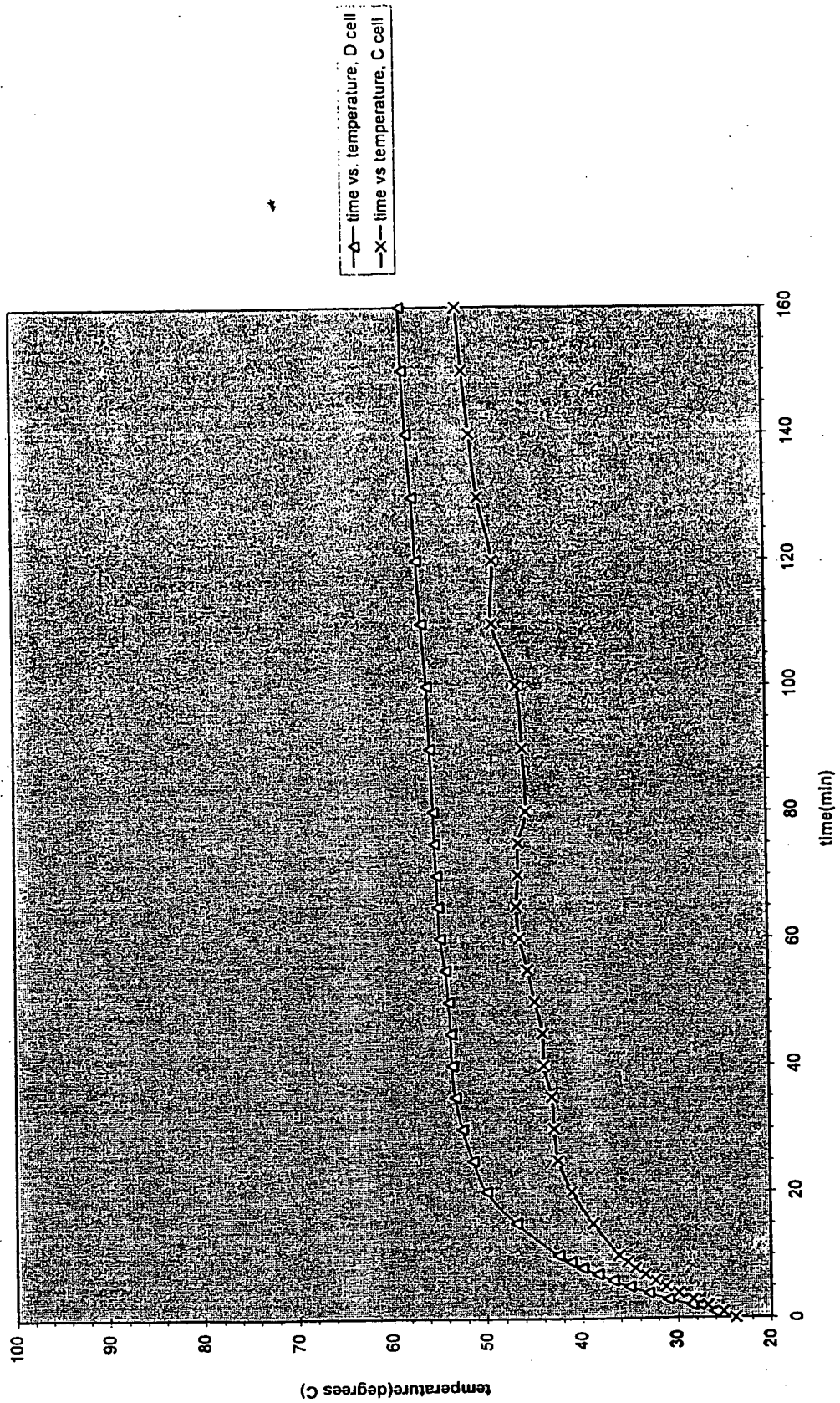
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6-27-94 Time vs Power Input

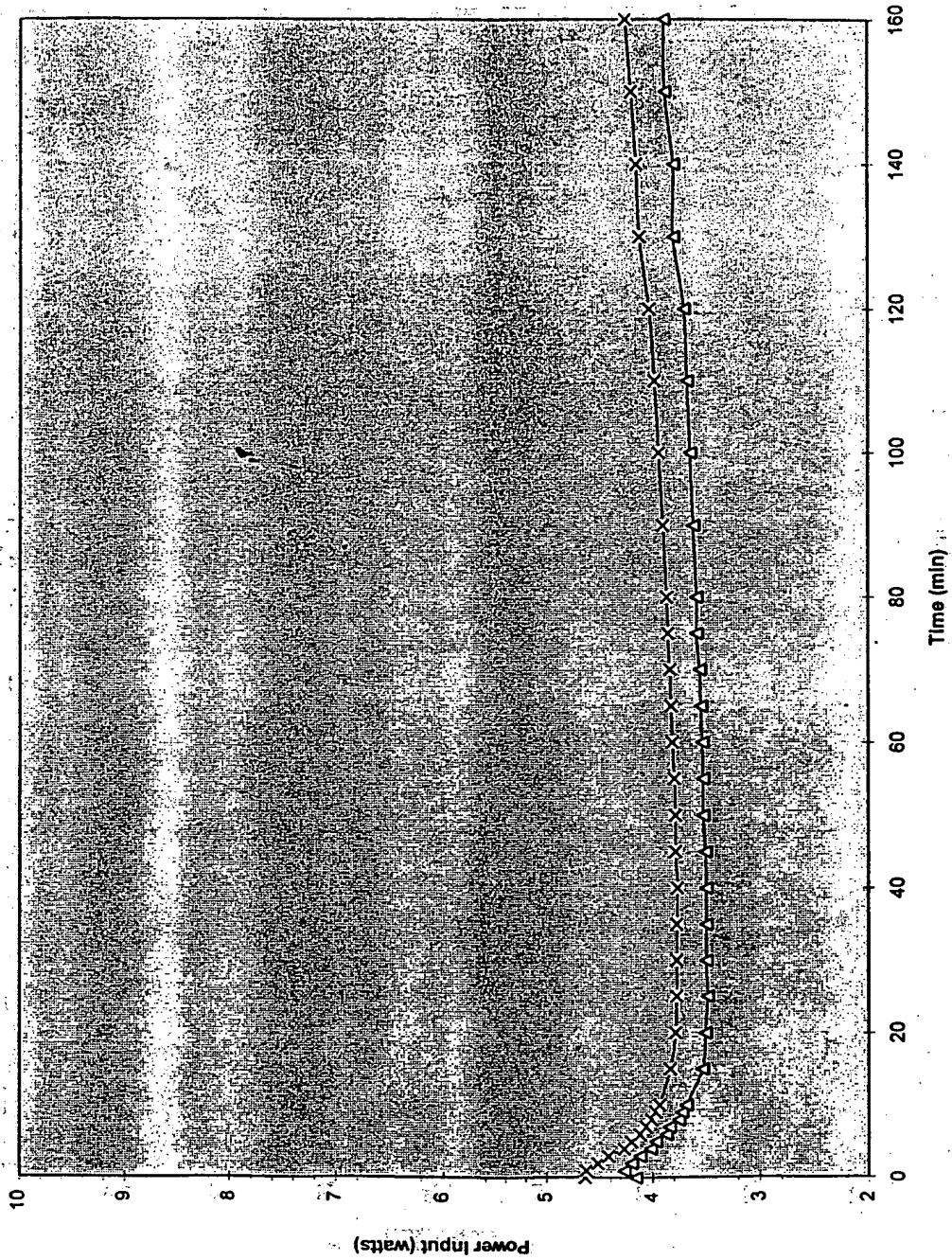


△—time vs power input, D cell
—X—time vs power input, C cell

6/27/94 Time vs. Temperature



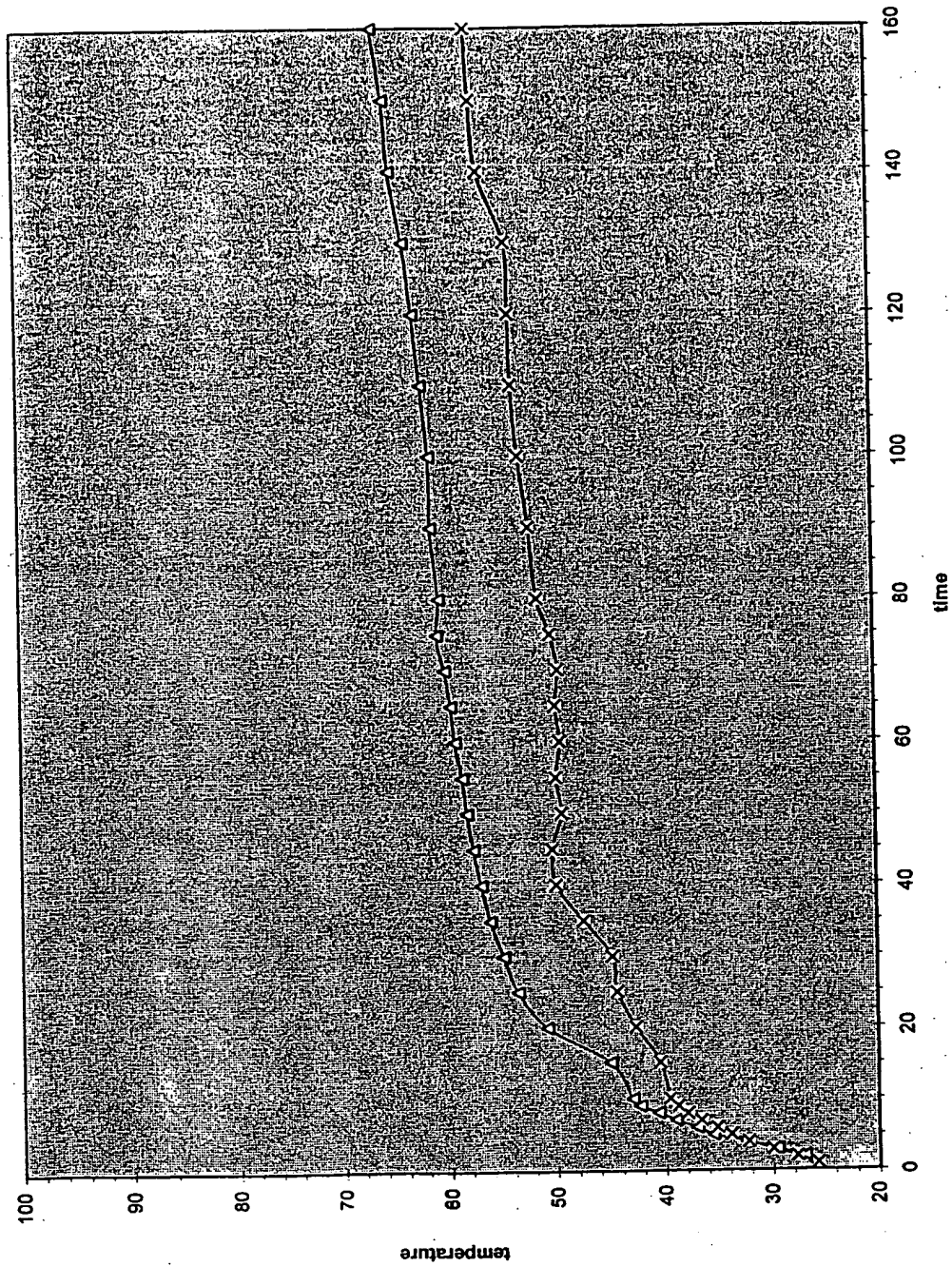
6/28/94 Time vs Power Input



—△— time vs power input, D cell
—X— time vs power input, C cell

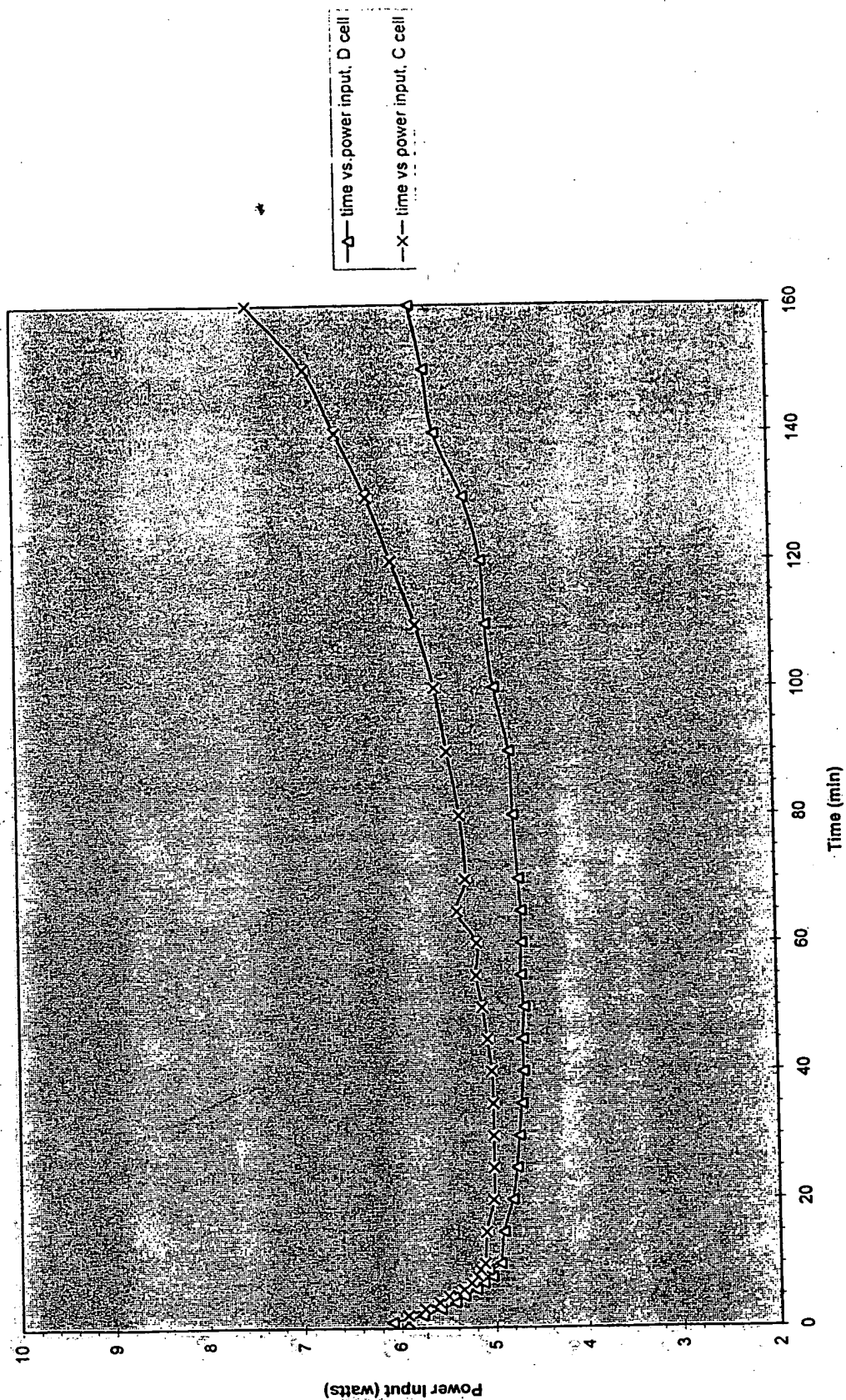
Sheet1 Chart 1

6/28/94, time vs. temperature



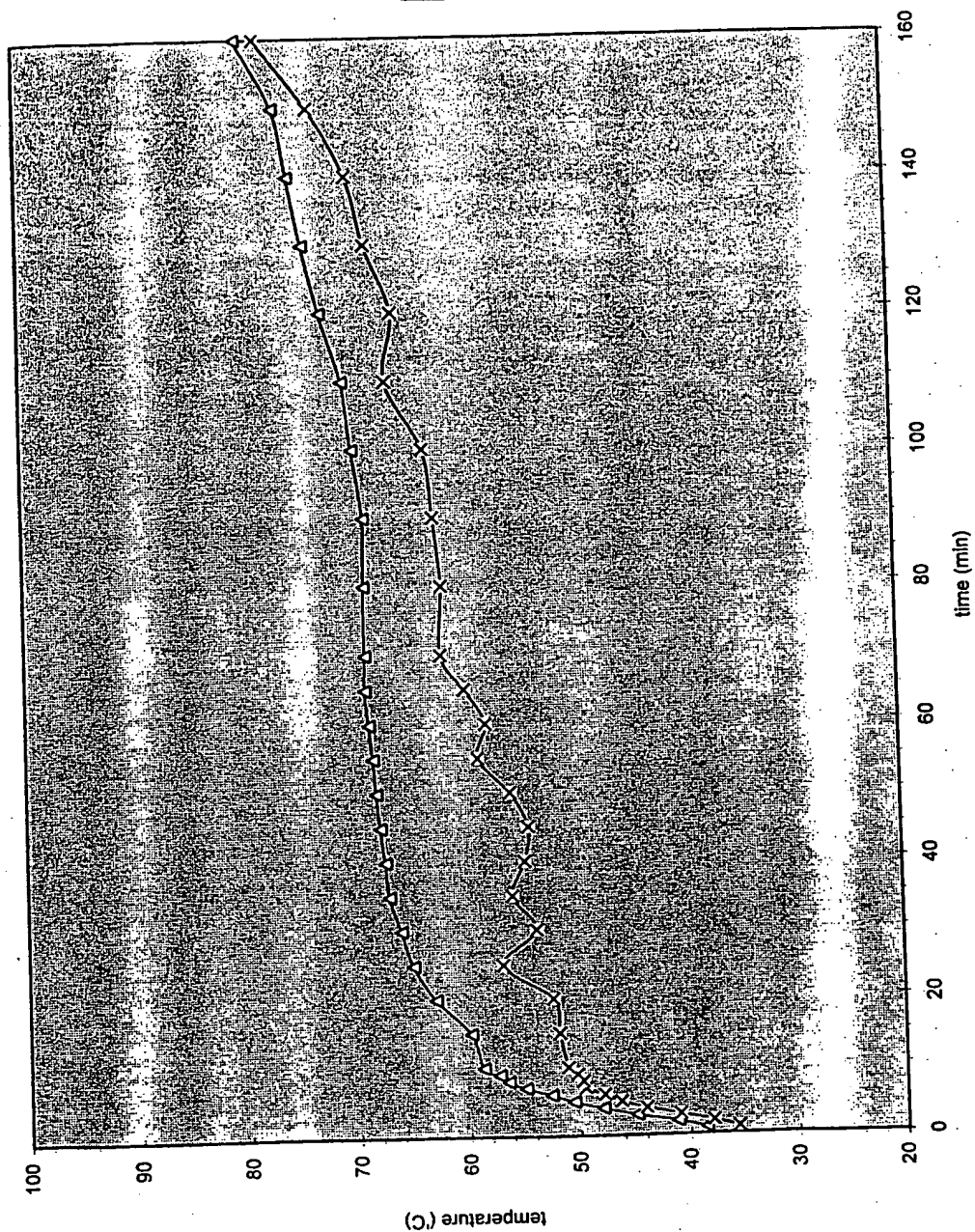
Sheet1 Chart 5

6-29-94 Time vs Power Input



Sheet1 Chart 1

6/29/94 time vs temperature



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Art Unit 2204

Serial No. 07/996,967

Filed: December 23, 1992

For: LOW TEMPERATURE NUCLEAR FUSION

Examiner: H. Behrend

THIRD DECLARATION PURSUANT TO 37 C.F.R. § 1.132

TO THE COMMISSIONER
OF PATENTS AND TRADEMARKS:

Sir:

1. I, John Dash, am a co-inventor on the application referenced above, which is a continuation application of U.S. patent application Serial No. 07/509,585, filed on April 16, 1990, entitled "Low Temperature Nuclear Fusion." I have read and understood the specification and claims of both of these applications.

2. I received a Bachelor of Science in Metallurgy from Pennsylvania State University in 1955. I then received a Masters degree in Metallurgy from Northwestern University in 1960. Finally, I received a Doctorate in Metallurgy from Pennsylvania State University in 1966.

3. I have had extensive training and experience in scientific research activities, including the physical and

chemical aspects of electrochemistry, since at least as early as 1955. I have been a professor at Portland State University since 1966. I currently am employed as a full professor of physics at Portland State University. A copy of my resume is attached to this Declaration as Exhibit 1.

4. I attended the International Symposium on Cold Fusion and Advanced Energy Sources at Minsk, Belarus, on May 24-26, 1994. At the conference, I attended a presentation by Dr. Francesco Celani from Istituto Nazinale Di Fisica Nucleare, Francati, Italy. Dr. Celani gave an oral presentation titled, "D/Pd Loading Ratio Up to 1-2:1 by High Power vs. Pulsed Electrolysis in Pd Plates."


Dr. Celani stated that the cathode he used for the experiments showed localized regions of deformation. He analyzed these regions of the cathode using energy dispersive spectrometry (EDS). Using this technique, Dr. Celani observed high concentrations of both gold and silver at the active areas of the Pd cathode. Dr. Celani stated that such concentrations of gold and silver could only have been produced through the absorption of neutrons by Pt and Pd. He also stated that the neutrons must have resulted from nuclear fusion.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information

and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or patent issued thereon.

7-22-94

Date


John Dash

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